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AGRICULTURAL ECONOMICS RESEARCH

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The 1950 Census of Agriculture as a Source of Basic Data for Economic Research

By Alvin T. M. Lee and Kenneth L. Bachman

Research workers in agricultural economics will find a wealth of source material in the reports on the 1950 Census of Agriculture. Inclusion of new items in the questionnaire accounts for some of the increase over previous censuses in the quantity of data published. Of special interest to research workers are the classifications which include tabulations of several key items of farm data by size of farm, type of farm, economic class of farm, and tenure of operator. Many of the other classifications represent merely a count of farms having given amounts of items such as number of cows or acres of wheat. Important uses of census data in agricultural economic research may be found in studies of the structure of agriculture in the United States and variations in the levels of productivity. Also, the data may have unusual value in providing a framework for selection, sampling, and generalization in agricultural economic studies.

PLANS for the 1950 Census of Agriculture provided for the tabulation and publication of many items of farm data for each major classification. This was made feasible by the use of State economic areas as the unit for tabulation and presentation of the statistics. Use of State economic areas reduced the number of reporting units from more than 3,000 counties to 362 groups of counties, all within State boundaries. The larger numbers of farms in an economic area as contrasted with the number in a county made it possible to obtain sufficient accuracy with the use of a sample. Use of the sample reduced the cost of processing, and use of State economic areas held the reporting units down to manageable proportions, as to both volume of material to be analyzed and publication space required. Nearly all of the data on farm characteristics relating to size, type, and class of farm, and tenure of operator are based on the tabulation of a sample comprising all large farms and 20 percent of the other farms.

State Economic Areas

The grouping of counties into State economic areas was a cooperative effort of the Bureau of the Census, the Bureau of Agricultural Economics, and the Scripps Foundation for Research in Population Problems at Miami University, Oxford, Ohio. State agricultural colleges and other agencies and institutions also participated in the review of areas as first delimited.

The general objective was to group the counties that were reasonably similar in natural resources, in kind of farming, and in population characteristics, but which differed in these characteristics from other nearby counties. Sixty items in these broad fields were tabulated and used as guides in grouping the counties. As

a broad objective each area was to include a minimum of about 100,000 inhabitants and 10,000 farms; but exceptions were made in a few instances. The State economic area is the basic unit for which most data on cross classifications have been published.[1] The 362 State economic areas have been grouped into 119 subregions.[2] This further reduction in number of units was effected largely by combining similar economic areas across State lines. The subregions were established cooperatively in the same way as the State economic areas.

The grouping of counties for portraying cross classification of census data was intended to be useful to several subject-matter fields. A different grouping would have resulted if only one or two subject-matter fields were to be served. It is hoped that research workers will be able, in most instances, to accept the areas as outlined. They should keep in mind the multiple-purpose use of these areas and exert care in generalizing on specific items as to their degree of existence in all counties within the area. For some work, such as preparing detailed maps showing type-of-farming areas, it will be preferable to work with county data when they are available.

All of the basic data on acreages of cropland, pasture, woodland, and individual crops, and on livestock numbers, sales of farm products, farm facilities, tenure of operator, labor resources, and other related data are available by counties as in past censuses. The classifications available by State economic areas, however, provide many data not available at the county level. Some of the classifications merely give a frequency distribution of the farms; others show a considerable quantity of data for each group of farms in the classification.

County data consist primarily of totals for the items enumerated, a count of farms reporting each item, and a count of farms for some of the same classifications made on the State economic-area level. Research workers can often, and with reasonable accuracy, interpolate data for the counties that differ significantly from the other counties in a State economic area. This can be done by using averages shown for the classifications within the State economic area and the number of farms as shown for the classification within the county.

[1] Bogue, Donald J. State economic areas. A description of the procedure used in making a functional grouping of the counties of the United States. Washington, D. C., Bureau of the Census.

[2] Totals of selected data from the 1950 Census of Agriculture for these 119 Economic Subregions appear in a special publication, "Farms and farm characteristics by economic subregions," Part 10 of Volume V of the reports of the 1950 Census of Agriculture.

Data and Classifications Available from the 1950 Census of Agriculture

Several basic differences in the methods employed and items enumerated in the 1950 census as contrasted with earlier censuses affect the quantity or quality of data available. The more important differences are the following:

1. Forty-one variations of the questionnaire were prepared in 1950 to permit the greatest possible adaptation to State conditions. In 1945 only 7 versions were adapted to groups of States. By having a separate questionnaire for each of most of the States it was possible to have the names of all of the important crops printed on the questionnaire. It was believed that this insured greater accuracy of enumeration than if it had been necessary to write in the names of crops frequently grown within some States but not produced nationwide.

2. More sales questions were asked in the 1950 Census of Agriculture than in any previous census. These ranged from 31 to 39 for individual States. In nearly all instances, each sales question followed the commodity or group of commodities to which it was related. This made it easy to relate sales to production during enumeration and during the editing of the questionnaire.

3. Value of products produced on the farms for use by farm families was not enumerated in 1950 as in previous censuses.

4. In previous censuses all of the information on land related only to the land that was considered to be operated by the respondent. In the 1950 census the respondent was asked to report all the land he owned as well as the land he rented from and to others. The classification of farms by tenure of operator may have been affected somewhat because of this slight change in classification criteria. The method used in 1950 made clearer to the respondent the acreage

and identification of the land toward which succeeding inquiries were to be directed.

5. In the 1950 Census of Agriculture the data on land values, farm facilities, farm labor, and expenditures were obtained only for large farms and for one in five of the remaining farms. These data were expanded to represent all farms. They are subject to considerable sampling error in some counties because of the small number of farms.

6. In 1945 and earlier censuses, enumerators were given the definition of a farm, and they were required to enumerate all places they found to be qualified. In 1950 they were asked to obtain an agriculture questionnaire for (1) each place that the operator considered a farm, (2) each place of 3 or more acres even though not considered a farm, and (3) certain specialized operations, such as nurseries and greenhouses, small poultry enterprises, and apiaries, regardless of acreage. By using this method more questionnaires were taken and later eliminated in the processing in 1950 than in any previous census. The final number tabulated in 1950 was less than that of any year since 1920. Questionnaires kept for tabulation in 1950 had to meet the following criteria: Places of less than 3 acres had to have sales of agricultural products in 1949 valued at $150 or more, while places of 3 acres or more had to have a total value of farm production (home use, not including garden, and sales combined) of $150 or more in 1949. The more rigid standard for a farm in 1950 caused a drop of about 150,000 to 170,000 places that would have been included as farms under the earlier definitions.

The causes of the remaining decrease were the enlargement of farms and the discontinuance of agricultural production on many residential farms that were included in the 1945 and earlier censuses.

A list of classifications made up of individual items of data from the 1950 Census of Agriculture is summarized in table 1. It shows the level on which the classifications were made—whether county, State economic area, or the State. Tables in which the data appear are identified. In most of these classifications a single item was merely sorted into frequency groups and a count made of the number of farms in each group. For some of the classifications listed in table 1 a tabulation was made of one, two, or more related items. The items tabulated were selective and not comprehensive enough to portray all the characteristics of the farms in the group.

In five classifications many farm characteristics are shown (table 2). At the county level the farms were classified into two groups, "commercial" and "other." County table 6 of Volume I presents separate data for these two groups of farms. This table helps to focus attention upon commercial farming in each county. The "other farms" consist of part-time, residential, and abnormal farms. These are often numerous but in most counties they account for an insignificant proportion or volume of the total farm sales. Deriving averages per farm for the commercial farms separately results in a more realistic average if one is concerned primarily with the commercial segment of agriculture.

At the State economic area level, four basic classifications were made—one for size involving 12 groupings, another for type of farm involving 12 groupings, a third for economic class of farm involving 9 groupings, and a fourth, 10 groupings by tenure of operator. Each of these classifications was independent of the others, except that a count of farms was made for each classification within each of the other classifications. For example, for each type of farm group there is a count of the farms (1) in each economic class, (2) in each size group, and (3) in each tenure-of-operator group. Averages of farm characteristics such as acres of cropland, number of cows, value of sales, and other items represent all of the farms in a given type group regardless of economic class of farm, size of farm, or tenure of operator.

Subsorting the farms on the basis of two or more characteristics represents a useful analytical tool for studying relationships in farm organization. For many purposes the farm characteristics for a three-level breakdown of the farms would be desirable. Such a stepdown sorting process for the commercial farms might be as follows:

First sort—Tenure of operator (4 groups)
(1) Full owners (2) Part-owners (3) Managers and (4) Tenants

Second sort—Type of farm (12 groups within each tenure)

TABLE 1.—*Farm characteristics by frequency distributions and where published in Volume I, 1950 Census of Agriculture*

Items classified	Where data are published in volume I		
	County table	Economic area table	State table
Operator			
Color	2		3, 5
Tenure by color of operator [1]	2a		3, 14, 15, 16
Age		1, 5, 6, 7, 8	5, 15
Years on present farm		1, 5, 6, 7, 8	5, 15
Off-farm work		1, 5, 6, 7, 8	5, 15
Residence		5, 6, 7, 8	5, 15
Acreage per farm			
Cropland harvested	1	5, 6, 7, 8	1, 15
Woodland pastured		1	
Woodland not pastured		1	
Livestock—Number per farm			
Horses and/or mules		3	
Cattle and calves		3	
Milk cows [1]		3	
Sows and gilts for spring farrowing		3	
Calves butchered		3	
Cattle, excluding calves butchered		3	
Hogs and pigs butchered		3	
Chickens on hand 4 months old and over [1]		3	
Specified crops			
Acres of corn for all purposes		4	
Acres of corn for grain		4	
Acres of sorghums for all purposes		4	
Acres of sorghums for grain		4	
Acres of land from which hay was cut		4	
Tons of hay sold		4	
Acres of potatoes [1]		4	
Other principal crops (varies by States) [1]		4	
Orchards			
Acres of land in orchards		4	
Apple trees of bearing age		4	
Apple trees of nonbearing age		4	
Bushels of apples harvested		4	
Peach trees of bearing age		4	
Peach trees of nonbearing age		4	
Bushels of peaches harvested		4	
Farm machinery, work power, equipment, and roads			
Class of work power	3	5, 6, 7, 8	7, 15
Kind of tractor [1]	3	5, 6, 7, 8	7, 15
Tractor by year of newest model		5, 6, 7, 8	7, 8, 15
Number of tractors per farm			7
Automobile by year of newest model		5, 6, 7, 8	7, 8, 15
Motortruck by year of newest model		5, 6, 7, 8	7, 8, 15
Kind of road on which located	3	5, 6, 7, 8	7, 15
Distance to trading center	3		7
Distance over dirt road	3		
Labor force			
Kind of workers for specified week [1]	3	2, 5, 6, 7, 8	9, 15
Expenditures for hired labor		2	9, 19 to 22
Hours worked by operator		2	
Number of hired workers			19 to 22
Number of seasonal hired workers		2	19 to 22
Number of regular hired workers		2	19 to 22
Wage rates paid			19 to 23
Hired workers by type of perquisites furnished		2	23 to 27
Hired workers by basis of payment [1]		2	19 to 27
Land values, taxes, and rent			
Value of owned land and buildings for full owners and part owners by taxes paid.			18
Value of rented land and buildings for those paying cash rent			17
Sales			
Value of products sold	7		

[1] For each of these frequency distributions, in addition to a count of farms reporting, there is also included a tabulation of one or more selected items. For example, in the distribution by number of milk cows there is tabulated the total number of cows milked yesterday, the quantity and value of cream sold, the quantity and value of whole milk sold, and the value of all dairy products sold.

(1) Cash-grain (2) Cotton (3) Other field crop, and so forth,

Third sort—Economic class of farm (6 groups within each type, within each tenure)

This sorting process would result in a possible total of 288 groups ($4 \times 12 \times 6 = 288$). Examination of the data in a few selected areas probably would show that most of the farms classify into only a few of the groups. A sorting process as illustrated would serve to weed out farms for the minor and unusual tenures, types, and economic classes in an area so that a major statistical analysis could be limited to the more significant groups. A two- or even three-way sort provides a method for making a more meaningful analysis of the data.[3] Table 3, which shows characteristics of dairy farms by economic class of farms for 7 selected State economic areas, affords an example of the kind of comparisons that could be made for similar classes and types of farms in various areas of the country if such tabulations were available more extensively.

[3] Exploratory work of this type was done in a special tabulation of economic classes within selected type-of-farm groups. The special tabulations were made for 19 selected State economic areas showing characteristics of farm organization for the modal economic classes within the most common type-of-farm groups in the area. Only the economic classes having approximately 500 farms within each type-of-farm group were included in the study. The smaller groups were considered as not having sufficient statistical reliability. The statistics for the 191 groups tabulated may be found in the special publication of subregions mentioned in this article.

Use of Data in Measuring Resource Productivity

Much attention has recently been given to levels of productivity in the farm and nonfarm sectors of our economy, especially among different groups of farmers. But measurement of even the relative levels of productivity has been greatly handicapped because data have been available only for conglomerate groupings of farms that cover a variety of situations from the standpoint of production conditions. Separation of part-time and residential farms from commercial farms and tabulation of information concerning resources, income, and expenditures by local areas make meaningful estimates of this nature a distinct possibility.

To make comparisons of resource productivity among farms in the United States, estimates are needed of output and resources for the important groups of farms in our agriculture. The 1950 census provides a basis for geographical and functional groupings such as type of farm,

TABLE 2.—*Farm Classifications—Number of groups in each classification, items tabulated and where published in Volume I—1950 Census of Agriculture*

Basis of classification	County [1]			Economic area [1]		
	Groups	Table number	Data tabulated	Groups	Table number	Data tabulated [2]
	Number			*Number*		
Size of farm (acres)	13	2	Number of farms Land in farms	12	5 and 9	241 major items of farm data showing the characteristics of the farms in each group.[3]
Tenure of operator	10	2	Number of farms Land in farms Cropland harvested	10	6 and 10	Do.
Type of farm	12	7	Number of farms	12	7 and 11	Do.
Economic class	9	7	Number of farms	9	8 and 12	Do.
Commercial and other	2	6	79 major items of farm data.			

[1] County and Economic Area tables each have a summary column giving State totals. Classifications for size of farm, tenure of operator, and type of farm are for commercial farms only.

[2] Identical items are tabulated in tables 5, 6, 7, and 8 and in tables 9, 10, 11, and 12.

[3] Tabulations include several subclassifications showing number of farms by such groupings as acres of cropland harvested per farm, days worked off-farm by operator, years on present farm, and by each of the other major farm classifications listed in this table.

TABLE 3.—*Characteristics of dairy farms, by economic class of farm, selected State economic areas, Part 10, Volume V, 1950 Census of Agriculture*

State economic area	Number of farms					Percentage distribution of dairy farms				
	Class II	Class III	Class IV	Class V	Class VI	Class II	Class III	Class IV	Class V	Class VI
	Number	*Number*	*Number*	*Number*	*Number*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
New York 6E	1,647	3,326	2,240	826	180	19.7	39.8	26.8	9.9	2.2
Ohio 2	220	655	820	620	280	8.4	25.1	31.5	23.8	10.7
Wisconsin 2A	667	4,430	6,466	3,080	795	4.3	28.6	41.8	19.9	5.1
Virginia 3A	113	125	220	361	500	8.4	9.2	16.3	26.7	37.0
Kentucky 6AB	392	1,070	1,151	715	640	9.8	26.8	28.9	17.9	16.0
Tennessee 5B	276	723	1,512	2,705	1,760	3.9	10.3	21.6	38.6	25.1
California 6E	510	745	495	315	70	20.3	29.7	19.7	12.6	2.8
	Acreage of land per farm					Acreage of cropland harvested per farm				
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
New York 6E	293.1	199.4	154.1	109.9	(1)	87.3	59.7	47.2	32.2	(1)
Ohio 2	(1)	157.1	103.7	58.5	(1)	(1)	99.2	61.1	28.0	(1)
Wisconsin 2A	319.2	195.9	143.1	106.1	86.7	148.2	89.7	60.0	39.8	26.9
Virginia 3A	(1)	(1)	(1)	(1)	89.1	(1)	(1)	(1)	(1)	15.3
Kentucky 6AB	(1)	159.8	124.8	96.3	70.3	(1)	50.9	30.0	18.3	9.8
Tennessee 5B	(1)	222.2	149.1	102.4	67.3	(1)	68.6	39.7	26.3	15.7
California 6E	191.1	80.8	62.4	(1)	(1)	49.3	28.1	16.6	(1)	(1)
	Milk cows per farm					Value of dairy products sold per farm				
	Number	*Number*	*Number*	*Number*	*Number*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
New York 6E	37.6	22.0	14.3	9.0	(1)	12,014	6,007	3,362	1,643	(1)
Ohio 2	(1)	14.0	8.7	6.0	(1)	(1)	3,702	1,760	913	(1)
Wisconsin 2A	28.4	19.1	13.7	9.1	5.8	7,217	4,070	2,440	1,336	678
Virginia 3A	(1)	(1)	(1)	(1)	5.1	(1)	(1)	(1)	(1)	379
Kentucky 6AB	(1)	17.7	12.1	7.6	4.4	(1)	4,040	2,087	1,110	359
Tennessee 5B	(1)	24.0	14.7	9.3	5.4	(1)	4,469	1,994	994	457
California 6E	42.2	24.7	14.4	(1)	(1)	11,967	5,055	2,690	(1)	(1)
	Percentage dairy products sold is of all farm products sold					Value of hogs and pigs sold per farm				
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
New York 6E	84.8	83.9	89.3	79.1	(1)	41	10	6	5	(1)
Ohio 2	(1)	53.4	50.3	52.4	(1)	(1)	879	442	155	(1)
Wisconsin 2A	53.7	62.5	66.8	69.5	74.0	1,610	741	232	94	40
Virginia 3A	(1)	(1)	(1)	(1)	53.0	(1)	(1)	(1)	(1)	25
Kentucky 6AB	(1)	58.5	55.3	59.9	54.0	(1)	271	142	74	22
Tennessee 5B	(1)	64.6	57.6	56.7	61.3	(1)	546	260	136	53
California 6E	77.0	72.3	74.7	(1)	(1)	171	46	43	(1)	(1)
	Value of poultry and poultry products sold per farm					Percentage of farms reporting milking machines				
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
New York 6E	452	253	90	69	(1)	94.5	87.2	76.6	44.2	(1)
Ohio 2	(1)	448	467	173	(1)	(1)	84.0	56.1	25.8	(1)
Wisconsin 2A	641	439	264	111	51	92.5	93.6	76.9	37.8	15.1
Virginia 3A	(1)	(1)	(1)	(1)	88	(1)	(1)	(1)	(1)	------
Kentucky 6AB	(1)	118	105	61	40	(1)	81.8	52.1	24.5	5.5
Tennessee 5B	(1)	80	94	69	49	(1)	71.9	33.1	9.8	4.0
California 6E	130	42	57	(1)	(1)	88.2	87.2	68.7	(1)	(1)

[1] Data not tabulated because of small number of farms.

economic class, and tenure of operator. Much of the information on output and resources is provided or can be estimated for these groupings. The value of the 1949 crops sold or to be sold and the value of livestock and livestock products sold were obtained in the 1950 census. Expenditures reported included: Labor and machine hire, feed and seed purchased, livestock purchased, gasoline and petroleum fuel and oil, tractor repairs, and machinery repairs. Information on resources reported in the census includes: Value of land and buildings; information on operator, family, and hired labor; number of specified machines; number of tractors, automobiles, and trucks; and number of livestock.

Although much information is available from the census there remain rather distinct limits to the degree of accuracy possible in measures of productivity developed from these data. The limitations arise from three major sources: (1) Underreporting of the value of sales, which varies considerably among the different farm commodities, (2) omitted items relating to output and input, and (3) definition of a farm.

Certain data concerning farm income and expenses were not obtained by the 1950 census. From the standpoint of the value of output, the value of home use must be estimated. Nearly two-thirds of the current expense items are covered in the items reported in the census. Fertilizer represents a major item omitted in the 1950 census.

Information on production and "product added" are useful when related to the resources used. Considerable information is given on resources but definite limitations and gaps exist. The value of land and buildings is similar to that obtained in previous censuses. Machinery values are omitted but information is given for numbers of certain specified machines. Numbers of productive livestock provide a basis for calculating value for this class of capital. Estimates of operator's labor available can be made for commercial farms (farming units) from information on the basis of amount of work off the farm and age of operator. Wages paid, together with numbers of hired workers, provide a basis for a reasonable estimate of hired labor requirements. But the only information on family labor in 1950, other than operator, relates to the numbers employed 15 hours or more during the week preceding the enumeration.

In the use of data concerning parts of the South where cropper operations are important, comparisons of product added by type and size of farm need to be analyzed carefully. The census counts as a farm each cropper and tenant operation. Where these form part of a plantation the data on machinery and some of the data on expenses are often enumerated with the plantation home-farm. But comparisons by areas relating to commercial farms as a group should be affected only slightly because most home farms are classified as commercial.

Calculation of accurate estimates of net income from census data alone does not seem possible. But meaningful estimates might be made of the relative quantity of product added, and of resources employed, for comparisons among broad groups of farms. Two studies of this type in a national perspective are now under way. One, in the Bureau of Agricultural Economics, is an analysis of major areas of low-production farms and levels of productivity. The other is a study of levels of productivity in United States agriculture being made by the Bureau of Agricultural Economics and Iowa State College cooperating.

Role of Census Data in Studies of the Structure of American Agriculture

Census reports before 1950 emphasized State and regional differences in the production and organizational characteristics of agriculture. The 1950 Census of Agriculture makes available comprehensive data for such functional groupings for areas within States.

These developments deserve special emphasis in studies of the economic structure of agriculture in this country. Much needed information relating to important sectors of agriculture is provided in data on the characteristics of commercial farms for economic areas, by economic class of farm, size and type of farm, and by tenure of operator. A frequent criticism of farm programs is that they are based too greatly on the assumption that all farms are commercial farms. Data from the 1950 census will permit much better comparisons and descriptions of both commercial and other farms by farming areas, with respect to the salient differences in

organization and production, than were previously possible.

Information on numbers and characteristics of commercial farms by economic class, type of farm, and tenure of operator for economic areas may modify some assumptions on which farm policy is developed. The distribution of farm operators by tenure differs considerably between commercial farms and all farms. The proportion of full owners is high among the part-time and residential groups.

Research in this area can provide useful information for the economic appraisal of many problems of our agriculture, such as questions of ownership, tenure, size of farm, resources, productivity, and stability of incomes. Information can be developed to answer such specific questions as: What are the apparent relationships of tenure to the adoption of technological development? Under what conditions do large-scale farms constitute an important sector of agriculture? How important are purchased inputs on various types and sizes of farms? How may net incomes be affected by changes in prices or yields?

Uses of Data in Selection, Sampling and Generalization of Research

A bridge for the integration of individual-farm and overall analysis is provided by the classification of farms in each economic area into size and type groups. For example, production possibilities for the chief type or size situations can be outlined by using these organizations as a framework. Similarly, given a general analysis of adjustments for an area in connection with production capacity studies as an example, the organizational data for major groups of farms make it possible in many cases to adapt such overall recommendations to the major organizational situations in the area. Although cross classifications are not available for many areas, type or size will frequently represent the significant breakdown from the standpoint of evaluating alternatives. In northeastern Montana, for example, the difference between wheat and livestock farms is of paramount importance for many purposes. In the eastern Wisconsin dairy area, on the other hand, size rather than type of farm may be the important breakdown for analyzing production possibilities.

A more desirable sampling system can be devised when more is known about the universe. Area stratification represents only one of the means to efficient sampling. These generalizations are particularly true of research in production economics, which usually studies relationships. As Heady has emphasized "... so much emphasis has been given the 'random versus block' argument that the real core of farm production economics sampling has been bypassed. . . . The appropriate sample is one which gives (approximately) equal ... distribution of the independent variable throughout the entire range of the data." [4]

The information made available by the 1950 Census of Agriculture provides a wide range of stratification that can be related to the purpose of the studies. As mentioned earlier, these include data by type of farm, tenure of operator, economic class, and size of farm. The availability of such data can make for easier sampling and generalization in studies of economy of scale, tenure, incomes, organization of the typical family-operated farm, production opportunities, and other significant research in production economics.

[4] HEADY, EARL. ELEMENTARY MODELS IN FARM PRODUCTION ECONOMIC RESEARCH. Jour. Farm Econ. 30: 222-223, May 1948.

Budgeting Techniques in Estimating Farm Adjustments and Marginal Returns

By Earl O. Heady and Ross V. Baumann

Prediction in production economics helps individuals and groups to make choices among the uses of resources. Prediction is usually made by using a sample drawn from a population in which the variables, quantities, or parameters to be estimated are already in existence. But in many situations with which biological and economic research workers deal, the parameters they want to predict are not found in an existing population because farmers have not yet used the recommended production techniques. They therefore frequently must formulate predictions either by inference from a sample that is assumed to represent a population, or by budgeting procedures. Conventional budgeting procedures frequently have limited usefulness because the empirical data are assumed to be discrete, linear, and without error. This article brings out some refinements in conventional budgeting procedure. These suggested modifications are believed to increase the information that can be gained from a small number of budgets, and to give greater knowledge of the predictional error involved.

ADJUSTMENTS IN FARMING, as in the change to soil-conservation systems of farming, may involve many changes in enterprise combinations and production practices. A conventional research procedure often used to test the validity of such a change is to construct a single budget for each of several alternative systems for a few so-called typical farms, and then handle each as a case study. Rather frequently, the budgets compare only the usual with the optimum in physical adjustments.

At least two assumptions underlie this typical budgeting procedure: First, that the population for which the budgets serve as an inference has a zero variance; and second, that the degrees in the adjustments are discrete and the relationships are linear. The assumption of linearity is the same as in the analytical procedure known as linear programming.[1] The treatment of variance is also similar in the two procedures.

The group of functional relationships might be presented in a single functional relationship. If we could synthesize the fixed and variable costs for a farm, we could express the total, average, and marginal cost functions as algebraic equations, and thus predict all points on the relevant curve.[2] This system provides a somewhat different form of estimate from a similar prediction of the same parameter based on a sample. This is particularly so if the prediction refers to a statement of probability. However, the one set of calculations that specify the nature of the fixed costs—the short-run production function or input-output ratio—and the prices of varying resources allow estimates at many points over a wide range of the relevant (independent) variable.

This method would become cumbersome because adjustments in the entire system of farming involve so many more variables and functional relationships than a simple cost function. Consequently, we have preferred instead to use refinements in budgeting procedures that allow some relaxation of the assumptions of zero variance for the population, discrete data, and linear relationships. In addition, our refinements permit the use of standard statistical procedures even though many research workers look upon budgeting as a nonstatistical technique. In the following paragraphs some of these procedures are outlined as we have applied them in research

[1] Cf. KOOPMANS, T. C., EDITOR. ACTIVITY ANALYSIS OF PRODUCTION AND ALLOCATION. New York, Wiley, 1951.

[2] Cf. HENRY, W. F., BRESSLER, R. G., JR., and FRICK, G. E. EFFICIENCY OF MILK MARKETING IN CONNECTICUT: 11. ECONOMIES OF SCALE IN SPECIALIZED PASTEURIZING AND BOTTLING PLANTS. Conn. (Storrs) Agr. Expt. Sta. Bul. 259, 1948.

studies. Our examples are drawn from a study of the economics of soil conservation.

Optional Budgeting Techniques

Our first refinement was to draw a sample that represented a homogeneous producing situation. Instead of studying a heterogeneous soil area in which the quantities and relationships estimated would be hybrids or averages representing the situation of no single farm, we selected a random sample of farms, all of which had essentially the same quantities and combinations of soils. A sample was drawn in the Marshall soil area of Iowa.[3] The sample included only farms of the most numerous size, that is, 160 acres.

Although there was great heterogeneity of soils in the areas, pre-established limits in respect to types and proportional acreages of soils were maintained in the samples used for study by selecting from a larger group of farms for which agronomists had made soil maps. The relevant population of farms was stratified on the basis of the degree of soil conservation before making the random selection from the field records of the county assessor. Data in table 1 for high- and low-conservation farms indicate the homogeneity of one sample.

Estimation of Relationships

Because soil conservation is not a discrete phenomenon—it can be attained in different degrees and a farm can move from one to other levels of erosion control—we constructed budgets for farms with similar resources which had various degrees of conservation attainment, and then employed regression analysis. This procedure eliminates the necessary assumptions of discrete alternatives and linear relationships.

More specifically, rather than construct budgets representing conservation and usual systems of farming for a typical farm, we computed conservation systems for 30 farms on Marshall soils that had already attained different levels of conservation. As a matter of convenience and practicability, soil loss in tons per acre a year was computed, both for present farming systems and recommended farming systems.

TABLE 1.—*Mean acreage per farm of specified soil types for high- and low-conservation farms*

Conservation	Acreage of specified soils				Total excluding roads
	Bottomland soils	Marshall silt loam		Shelby silt loam	
		Less than 4-percent slope	4-percent slope or over		
	Acres	*Acres*	*Acres*	*Acres*	*Acres*
High conservation.	24.9	35.0	90.8	4.9	157.1
Low conservation.	25.3	39.4	86.3	9.9	158.5

Heady and Allen, ibid.

After budgets were constructed for conservation adjustment, regression analysis was used to predict changes in returns, costs, and resource requirements for a single farm as it adjusted to different conservation levels. (This analysis was also made for several farms differing in existing levels of attainment as they adjusted to a given level of soil conservation.) Each budget was treated as an observation and the statistical analysis was carried forward accordingly. Regression curves, such as the ones presented in figure 1, were the result in the Marshall soil study.

Thus, rather than compute a budget representing the income, for example, for each point along the current conservation scale—the horizontal axis in figure 1—we were able to estimate an infinite number of budgets by the application of regression analysis to our budgets for 30 farms. The income figures estimate the addition to returns that would be forthcoming if farms of different levels of conservation attainment were to adjust to a specified goal, roughly a soil loss of 6 to 7 tons an acre a year.

This is in contrast to the conventional procedure of using a case-study budget, or of averaging several budgets into a mean prediction in which the estimate applies only to farm-

[3] The results of the application of the methods here outlined as a part of the study in the Marshall soils area are reported by Heady and Allen, in RETURNS FROM AND CAPITAL REQUIRED FOR SOIL CONSERVATION FARMING SYSTEMS. Iowa Agr. Expt. Sta. Research Bul. 381. Further results from this study and from one in the Ida-Monona soils area are expected to be available in the near future.

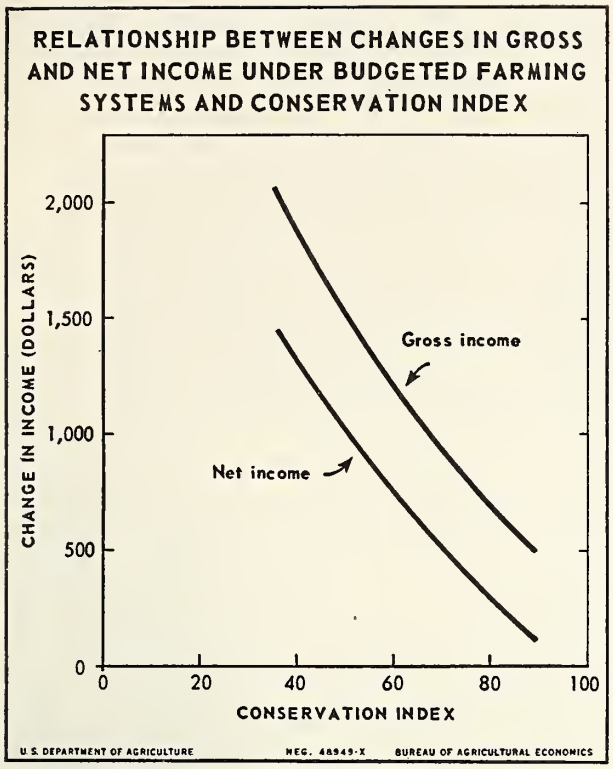

FIGURE 1

ers whose situations were characterized by the mean condition.

In addition to making it possible for us to estimate the results for a large number of budgets without the labor of actually constructing all of them, our procedure also allowed us to test the hypothesis of linear against curvilinear relationships, or constant against increasing or decreasing productivity of resources. In the example cited in figure 1, the regression coefficient for the squared term was significant at the 5-percent level of probability. We therefore accepted the hypothesis of a nonlinear relationship.

If our relationships were linear and our population had a zero variance—implicit assumptions that are usual in budgeting—the procedure could be simplified even more. We could have constructed two budgets, one at each extreme of our observations, and predicted all of the budgets in between as points on our straight line or linear relationship.

Estimational Errors

Furthermore, in our procedure we are able to specify a probability range that is due to variance in the characteristics of the farms in our sample. To illustrate this possibility, let us examine our estimates of the marginal value returns from capital invested in soil conservation for 12 farms with an annual estimated soil loss of 40 to 50 tons an acre a year. (The capital requirements would be rather large for any changes to accomplish more conservation.) These estimates are based on a number of alternative budgets for each farm, with a regression equation used to estimate the total returns function as varying quantities of capital are invested in soil-conservation adjustments.

Total returns attributed to conservation investment are related to capital invested in soil conservation and related farm adjustments. Total capital includes the cost of soil conservation practices, annual cropping practices, livestock, livestock equipment, purchased feed, the value of labor beyond 15 man-months a farm, fuel and machinery, and miscellaneous costs, although the annual outlay for some of these items would entail an investment of less than a year.

Equation 1 below shows the computed regression equation relating total returns (I_m) from conservation (beyond that currently attained) to total capital investment. Equations 2 and 3 show the returns at the upper (I_u) and lower (I_l) fiducial limits at a 5-percent level of probability for each regression coefficient:

$$I_m = 0.693 + 36.513C - 0.00272C^2 \quad (1)$$
$$I_u = 0.693 + 41.515C - 0.00302C^2 \quad (2)$$
$$I_l = 0.693 + 31.511C - 0.00242C^2 \quad (3)$$

From these data we are able to estimate the total return from various amounts of capital that are included in our range without constructing a like number of budgets. We also can specify the equations (by computing the derivatives of the three equations above) indicating the marginal returns (MR) per dollar of capital. These are given in equations 4, 5, and 6 for the mean, upper, and lower limits, respectively:

$$MR_m = 36.513 - 0.00544C \quad (4)$$
$$MR_u = 41.515 - 0.00604C \quad (5)$$
$$MR_l = 31.511 - 0.00484C \quad (6)$$

Using these data to estimate the marginal returns per dollar when $2,000 and $4,000 are invested in conservation farming systems, we obtain the figures for marginal returns in cents

(table 2).[4] We can show the added return per dollar of capital in many different quantities. We do not have to make out 6,000 budgets to estimate returns on capital ranging from $1 to $6,000.

TABLE 2.—*Marginal returns from capital invested in soil conservation on Marshall soils, 1945 prices*

Item	Marginal returns per dollar with additional capital investment of	
	$2,000	$4,000
	Cents	*Cents*
Mean	25.63	14.75
Upper limit	29.44	17.36
Lower limit	21.83	10.15

We are also able to specify a probability range, rather than present our data as the given figures, that is, estimates without variance, as is the common procedure in budgeting. Even at the lower limits, capital invested in conservation farming systems appears profitable, and confidence in our estimates is accordingly increased. Although conservation can be attained in varying degree, numerous practices are discrete. Our procedure gives us some confidence that conservation investment on this particular group of farms is profitable within a reasonable range of capital.

Limitations and Other Problems in Estimation

The ranges of error or fiducial limits that relate to the estimates do not take into account differences occasioned by year-to-year variations in weather and prices. The sample was taken in 1946 and yields were based on 10-year averages.

Neither do they take into account any error attached to the technical coefficients employed in the budgeting process. Technical coefficients such as crop yields for different practices and livestock-feed ratios were taken mainly as averages from experiments or as estimates provided by agronomists and animal husbandrymen.

Errors for technical coefficients could include those that are a result of (1) variance due to experimental error if the coefficients were used directly as derived, or (2) estimates of individuals in adapting the data for use in new situations, or (3) errors involved in the use of informed guesses. Errors resulting from experiments (1) can ordinarily be measured rather well statistically although the application of the data in new situations (2) might increase the errors. These would be difficult to measure, yet to a degree they could be explained. Errors involved in the use of informed guesses (3) would be difficult to measure objectively or even to describe in any but the broadest terms.

If estimates of the error of inference for the technical coefficients were available, we might have computed two additional sets of budgets, using the technical coefficients set at the 5-percent fiducial limits. The process itself, however, might involve several unanswered questions as: Are the several error quantities additive or must they be compounded? Should the functions fitted include the mean estimate based on average coefficients, the upper limit of the functions estimated with technical coefficients at the upper limit of the fiducial range, or the lower limit of the functions estimated with technical coefficients at the lower limit of the fiducial range, that is, the fiducial range for the technical coefficients themselves?[5]

But we believe that, aside from the common reservations which can be applied to the budgeting technique, not discussed here, our refinements represent an improvement on those procedures which assume budget data to be entirely discrete, linear, and without error of any nature.

[4] Marginal returns on capital are high on this particular sample of farms because their cropping systems are poor, they have little livestock, and they do not use their labor fully. Some individual capital items, such as seed for legumes, which might serve in a complementary capacity to grains, actually will return several hundred percent on the investment.

[5] Our estimates, like many others, do not include analysis of the time components of income and investment; neither do they adequately account for managerial differences and the capital-uncertainty complex.

Trends in Numbers of Farms as Factors in Livestock Estimating

By J. C. Blood and C. J. Borum

Current estimates of livestock and poultry numbers made by the United States Department of Agriculture are derived from farmers' voluntary reports, with the help of benchmarks that are established every 5 years when a new census is taken. After every census the Department reviews the series of estimates for the preceding 5 years and makes revisions to bring it into line with the new benchmark. Rather large revisions were required in some cases when the results of the 1950 census became available. This paper discusses some of the reasons for the discrepancies and suggests changes in estimating procedures that might avoid errors of the kind made between 1945 and 1950. The suggestions are based upon an analysis of Michigan data made by Mr. Blood and Mr. Borum.

ESTIMATES of the numbers of livestock and poultry are derived from the Rural Mail Carrier surveys of June and December. The estimating procedure is basically one of computing an average per farm from the survey data for each livestock or poultry item, and reading a chart on which past numbers are plotted against the averages thus obtained. In addition to indicated numbers shown by the per farm averages, an indication of change is derived from "identical" farms in the samples for two successive years. Data for the same farms, reporting in both years, are matched and the percentage change that is indicated by this matched sample is applied to the previous year's estimate. Because of selectivity in the samples, the ratios computed from the sample data are converted into unbiased ratios by reading a chart on which "true" ratios for past years were plotted against the ratios actually computed from the sample data.

The "percent-change" method can also be used with the per farm averages; an example of that approach is given in this paper. When estimates are derived by the "percent-change" method, a base is needed for the start of a series of estimates. A new base is established every 5 years when census data become available. Other information may be used along with census data in setting the benchmark.

As the Rural Mail Carrier samples are not probability samples they are subject to various kinds of selectivity. Apparently the most serious selectivity is represented by the tendency for farmers who keep no livestock to disregard the questionnaire; when a farmer stops keeping livestock, he stops returning any livestock questionnaires that may be put in his mail box. For that reason it has long been customary to discard the few questionnaires that show no livestock, but which actually are returned, and to compute per farm averages only for farms that report some livestock. Questionnaires that show no livestock but that do show some poultry are used for poultry estimates, even though they were discarded for livestock estimates. Poultry estimates are derived from per farm averages for farms that show poultry. For the identical-farm estimate of poultry numbers, the statistician uses reports for farms if the questionnaires show some poultry for *either* the current or the past year, or *both*.

By these procedures the statistician is making the tacit assumption that the numbers of farms keeping livestock and poultry are constant from year to year. In the case of the identical-farm estimates, partial allowance is made for changes in numbers of such farms because of the "either-or" feature, but the effect is not enough to reflect adequately the changes in numbers of livestock and poultry farms.

In retrospect, it is now apparent that there has been a consistent downward trend in the total number of farms during the last 15 years. In addition, there have been consistent downward trends in the percentages of farms that keep livestock and poultry. The combined effect of these trends, all working in the same direction, has been to introduce sharp downward trends in numbers of livestock and poultry which were not wholly reflected in the estimates made currently between 1945 and 1950. The

nature of these trends can be visualized by looking at census data for Michigan (table 1).

TABLE 1.—*Farms reporting cattle and chickens, Michigan, specified years*

Year	Number of farms	Farms reporting	
		Cattle	Chickens
	Thousands	*Thousands*	*Thousands*
1935	197	164	163
1940	188	149	146
1945	175	136	134
1950	156	114	105

It is clear that the Department's current estimates of livestock and poultry numbers should be made by a procedure that fully recognizes such trends and makes proper allowance for them. At present we have no formally adopted procedure for doing so. But we can use some devices for truing up our estimates that should keep them more nearly in line with the actual situation and that might be used until facilities for doing a more elaborate job are available.

An Approach Tried in Michigan

We could arrive at current estimates of numbers of farms keeping livestock and poultry merely by projecting the time trends shown by past census data. In some States this would perhaps be as good as, or better than, any projections based on data that are collected currently. In Michigan the total acreage of farm land in the State remains fairly constant; therefore, reductions in the total numbers of farms are accompanied by increases in the average size of farm. The average size of farm reported in our sample surveys shows an upward trend that reflects the trend in average size of farm for the State as a whole. This provides a basis for making current estimates of change in total number of farms. The general crop reporters provide data that can be used to measure changes in the percentages of farms that keep milk cows and chickens. The farms of these reporters are a more representative cross section of all farms in the State than are the farms covered by respondents to the livestock surveys. By noting the relative numbers of general crop reporters who reply to the questions on production of milk and eggs, we obtain a good index of the changes in percentages of farms that keep milk cows and chickens. Unfortunately, these reporters do not provide data on changes in numbers of farms keeping other kinds of livestock or poultry, but the present study does suggest how we might proceed to get similar data on those items.

Let us consider the problem of estimating the numbers of chickens on Michigan farms from the December livestock survey. Table 2 represents a simple set of arithmetical computations, applying the "percent-change" concept, that can be used to estimate those numbers for the years 1941-51, using the 1940 number as a base.

The data in column (1) are the average numbers of chickens, per farm reporting chickens, as reported in the December livestock survey. The data in column (2) express each average in column (1) as a percentage of the average for the preceding year. Column (3) shows the estimated number of chickens on Michigan farms, derived from the ratio in column (2) and the 1940 benchmark of 11.7 million chickens. These estimates assume no changes in numbers of farms keeping chickens; they need to be adjusted for that factor. The necessary adjustment factor is derived from the data in columns (4) and (5). For example, the average farm size in 1941 was 102 percent of the average size in 1940; this means that the relative *number* of farms in Michigan in 1941 was 100/102 times the number in 1940. At the same time, the percentage of farms keeping chickens in 1941 was 104 percent of the percentage in 1940. Therefore, the relative *number* of farms keeping chickens in 1941, as compared with 1940, was $\frac{100}{102} \times \frac{104}{100} = \frac{104.}{102}$ The estimated number of chickens on Michigan farms in 1941, corrected for change in the number of farms keeping chickens, is $\frac{104}{102} \times$ 11.6 million = 11.9 million. The estimated number of chickens for each year shown in column (6) is thus obtained from the formula, $\frac{\text{col. (3) x col. (5)}}{\text{col. (4)}} = \text{col. (6)}$.

It is apparent that the estimates shown in column (6) agree closely with the Crop Reporting Board's revised estimates appearing in column (7). The relationship between the two series is shown graphically in the chart (fig. 1).

TABLE 2.—*Estimated number of chickens on farms, Michigan, 1940 - 51*

Year	Chickens per farm		Chickens on farms ignoring trend	Index numbers 1940 = 100		Chickens on farms	
	Actual (1)[1]	Ratio to prev. year (2)	(3)	Size of farm (4)[2]	Percentage of farms keeping chickens (5)[3]	Estimated (6)	"True" (7)[4]
	No.	*Percent*	*Millions*			*Millions*	*Millions*
1940	101		11.7	100	100	11.7	11.7
1941	100	99	11.6	102	104	11.9	11.6
1942	103	103	11.9	103	105	12.2	12.1
1943	115	112	13.3	107	105	13.0	13.2
1944	128	111	14.8	112	112	14.8	14.2
1945	119	93	13.8	117	109	12.9	12.6
1946	120	101	13.9	118	108	12.7	12.9
1947	109	91	12.6	116	105	11.4	11.0
1948	107	98	12.3	117	101	10.6	10.4
1949	105	98	12.1	120	97	9.8	9.7
1950	120	114	13.8	121	97	11.1	10.9
1951	115	96	13.2	121	96	10.5	10.4

[1] Hens and pullets per poultry farm as reported in December rural carrier livestock survey.

[2] Derived from September rural carrier acreage survey (percentage of average size of farm reported in 1940).

[3] Derived from average percentage of farms reporting on egg production in the monthly general crop surveys for November, December, and January. (Index derived by expressing percentage for any year as percent of 1940 percentage).

[4] Crop Reporting Board estimates as revised after the 1950 Census.

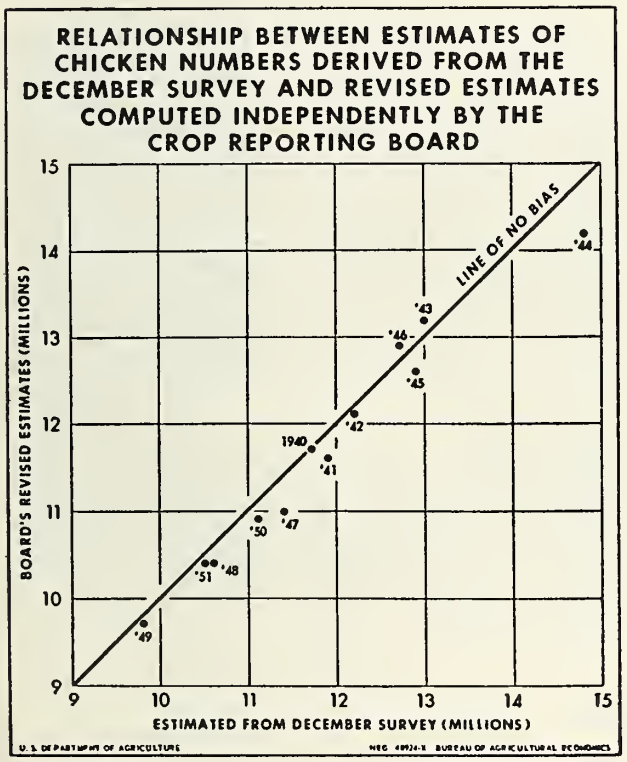

FIGURE 1.

Reference to column (3), which shows estimates uncorrected for trend, indicates how large an error would be made by neglecting that trend; the error becomes progressively larger as we get farther away from the base year, 1940. The agreement between the series in columns (6) and (7) is particularly significant because the Board's revised estimates were prepared without benefit of computations of the kind described here. The squared coefficient of correlation between the two series of estimates is $r^2 = 0.972$.

It is appropriate to say a few words about the variables used in the preceding computations. The percentage of farms reporting production of eggs in the general crop surveys varies somewhat from month to month. For that reason the average percentage for November, December, and January was used in the computations. We used the average reported farm size in the September acreage survey to derive the index of average farm size. We also tried the same computations as above, but using the average farm size reported in the December livestock survey. The results were approximately the same as be-

fore, except that the squared coefficient of correlation of the estimates with the Board's revised estimates was a trifle smaller: $r^2 = 0.923$.

Similar computations were made with data from the identical farms. The results were about the same as those obtained from the entire sample, except that the estimates appearing in column (3) of the tables were considerably closer to the revised series before the correction for trend was applied. The squared coefficient of correlation between column (6) and column (7) was 0.925 when the index of farm size was derived from the September acreage survey, and 0.954 when the reported farm size in the December livestock survey was used.

We investigated the possibility of arriving at a better estimating equation by fitting a multiple regression equation to the data, using the revised estimate as the dependent variable and the reported data on chicken numbers, average farm size, and percentage of farms keeping chickens, as the independent variables. The squared coefficients of multiple correlation were higher than the squares of the simple correlation coefficients quoted above. However, the increases were not large enough for us to recommend this procedure, in view of the greater complexity of the arithmetic involved in the computations.

Livestock Estimates

The same procedure suggested for use in estimating numbers of chickens can be used to estimate numbers of milk cows. The percentage of farms reporting milk production in the monthly general crop surveys provides an index of the percentage of farms keeping milk cows. The results obtained in Michigan are comparable with those of the chicken estimates.

For estimates of all cattle, all horses, sheep, hogs and farrowings, we have no current data on percentage of farms having those items. But, we can project the census trend of number of farms keeping livestock and also interpolate figures between censuses. If we express the data from the livestock surveys as averages per livestock farm, and multiply those averages by the estimated numbers of livestock farms, we should arrive at indications of livestock numbers that are highly correlated with the corresponding "true" values. Making such computations for the years 1940-51, and plotting the Board's revised estimates against these indications, gives estimating charts that show high degrees of correlation between the sample indications and the corresponding true values. For the years under study, the squared coefficients of correlation for various livestock items in Michigan are shown below. Chicken numbers have been included for comparison with the results obtained previously by the other methods.

Item	Squared coefficient of correlation of indication with Board's revised estimate
All cattle (Jan. 1 inventory)	0.966
All horses (Jan. 1 inventory)	.988
Stock sheep (Jan. 1 inventory)	.993
All hogs (Jan. 1 inventory)	.961
Spring farrowings	.979
Fall farrowings	.985
Hens and pullets (Jan. 1 inventory)	.975

Conclusions

Satisfactory estimates of livestock and poultry numbers can be obtained from our Livestock Surveys only when proper allowance is made for changes in the numbers of farms keeping those items. Accurate estimates of such changes would require facilities that are not now at our disposal. In the meantime, it appears that our current estimates of livestock and poultry numbers can be improved by the use of rather simple devices which require only an intelligent use of data now available to us in census records and from surveys conducted by our offices. Perhaps a few questions on kinds of livestock kept should be included on our acreage questionnaires. That would provide data on other kinds of livestock, somewhat comparable to the data on percentages of farms keeping chickens and milk cows, which can be extracted from the monthly general crop questionnaires.

Book Reviews

Introduction to Economics for Agriculture. By JOHN DONALD BLACK. The Macmillian Company, New York. 1953. 727 pages. $6.00.

DR. BLACK never hesitates to state his viewpoints with boldness and self-assurance. A man who had less experience and fewer accomplishments than this author would hardly venture so bold a claim for a work as Dr. Black does for his *Introduction to Economics for Agriculture.* In his preface, referring to elementary instruction in economics now offered in agricultural colleges, he states that "... with this book available, many colleges will no longer consider necessary or desirable such a preparatory course in general principles. This book gives all the general principles, and all the background in the general economy, that the usual agricultural college student needs, and does it with much better integration than is likely with separate courses."

Inasmuch as Dr. Black established his own goal I immediately tried to learn whether he reached it. My studied reaction is that he will at least find this is still a matter of lively controversy among some of his colleagues. In a characteristic fashion he constructed his problem, gave it vitality, and created interest in it. But I doubt sincerely whether this one text alone will achieve his real objective: "To give an agricultural college student, or educated farmer or his equivalent, exactly that understanding of economics which he or she needs in order to function effectively and live happily in the world of today."

Despite his failure to achieve the impossible goal he set for himself, I would recommend the book as the basic text for an undergraduate class in agricultural economics. I can conceive of an excellent undergraduate course being developed with Dr. Black's text as a starting point. To do this the instructor would need to use a well-chosen supplementary reading list and to expand and illustrate thoroughly many of the vital points raised by the author.

The informality and ease with which Dr. Black goes through the section on orientation is refreshing. He reminds me of an old master standing before his students as he draws on his reservoir of knowledge to paint with broad strokes a word picture of the past to arrive quickly at the subject nearest his heart. But in following such a procedure he leaves out much that is essential in a student's orientation to economics. What he does really is to construct a ladder—a ladder to a platform from which a student can observe and react intelligently to a panorama of economic facts which, when integrated, will offer him a rational explanation of economic actions.

Few men can draw on the wealth of experience in teaching, research, and government regulation of business and agriculture that Dr. Black uses to develop his ideas on production, consumption, and marketing. On occasions the author's rapier-like thrusts at some distasteful governmental policy may leave his reader aghast. But this is momentary, because Dr. Black is soon on to a new subject, without even a slight pause.

The range of subjects covered in the text is wide indeed. Organization of subject matter is excellent. Dr. Black does extremely well in his chapters on production, consumption, and commodity distribution. He is stimulating and provocative in his chapters on public economics. In fact, he raises several very pertinent questions regarding the role of government in agriculture that should be answered by those who believe that agriculture is incapable of standing on its own feet.

While I cannot agree that Dr. Black altogether reached the goal he set for himself, yet there always has been a need for a readable, teachable, and informative text in agricultural economics. On this basis he has succeeded. The problem of including only one course in economics in all the curricula in a college of agriculture must be solved as a separate issue.

D. B. DeLoach

Law and the Farmer. By JACOB H. BEUSCHER. Springer Publishing Company, Inc., New York. 1953. 406 pages. $4.95.

FOR SEVERAL YEARS Professor Beuscher has conducted a course in farm law for future farmers, county agents, agricultural specialists, and vocational agriculture teachers in the College of Agriculture at the University of Wisconsin. At the same time he has taught in the University Law School and conducted "law-in-action" studies aimed at discovering how certain laws actually operate at the farm level.

His quest for better teaching techniques for persons not trained in the law has resulted in the new approach that is used in this book. It centers discussion of legal rules and principles around several hundred farm legal problem situations that are familiar to most farmers. The method reduces to a minimum the use of technical law-book phraseology and language familiar to the layman is substituted.

The book opens with a discussion of the role of law in preventing disputes, as contrasted with its more dramatic role in settling them. Readers are then familiarized with different kinds of laws and how they are made. Among these laws are statutes passed by Congress and by State legislatures; ordinances by counties, towns, and cities; case law by Federal and State courts; and a growing body of administrative rules and regulations, having the force of law, issued by Federal and State administrative agencies. Attention is called to such traditional divisions of the law as public versus private, civil versus criminal, and substantive versus procedural; and to law-school classification by subject matter, such as contracts, torts, real property, agency and criminal law. "Farm law," it is pointed out, is not a separate division of jurisprudence; it is a term used merely to focus attention on some laws that most concern farmers.

The reader's introduction to numerous rules and regulations that affect farmers begins with an examination of the many legal problems involved in buying and selling a farm. Here, a brief but excellent treatment of basic principles of contract and real property law opens the door to an understanding of legal problems discussed in later chapters.

A section that deals with transfer of the family farm from one generation to the next establishes a new benchmark for future research and writing in this field. In six chapters that blend into one another, the author gathers together the law pertaining to father-son operating agreements, transfer arrangements between the living, transfer on death by will and where there is no will, probate procedures, and gift and death taxes.

Other legal problems that are treated in the book include Federal, State, and local regulations that pertain to the farming business; taxation of farm property and of farm income; and legal rules that relate to secured and unsecured farm debts, to fences and boundaries, to rights in water and streams, and to the farmer's liability for careless acts.

This is Professor Beuscher's second book on farm law. His first, *Farm Law in Wisconsin*, published in 1951, was prepared for Wisconsin farmers. In his present work, which was written for a national audience, the diverse legal rules of the 48 States are grouped into logical patterns or presented in tables, thereby avoiding a morass of detail. Space limitations preclude discussion of all the farm legal problems that might arise, or of all the law that is applicable. Only the more important problems are treated. But enough law is presented to achieve the primary aim of the book, that is, to enable the lay reader to detect legal pitfalls and thereby avoid costly mistakes. Readers who wish to pursue a subject further will find useful sources cited in footnotes; and helpful questions for students follow each chapter.

This volume is a welcome presentation of farm law. It is written in language that can be understood by farmers, students, and others not trained in the law. Educators will find it a readable and useful book in their classes. It should not be overlooked by agricultural economists who at times fail to perceive the profound influence of the law as a social institution affecting, and in turn affected by, economics.

Erling D. Solberg

Demand Analysis. By HERMAN WOLD, in association with LARS JUREEN. John Wiley & Sons, Inc., New York. 1953. 358 pages. $7.00.

STATISTICAL DEMAND ANALYSIS is a synthesis of several disciplines—economic theory, probability theory, and mathematical statistics—applied to concrete data. Each application requires special knowledge of the commodities involved and the adequacy of the statistical series which purport to measure their prices and quantities. This last type of knowledge comes slowly, and is most likely to be acquired by economists who are specializing along commodity lines. Few commodity economists have the time or the predilection to master in their entirety the theoretical disciplines upon which demand analysis also rests.

These disciplines themselves are generally taught in such a way as to discourage anyone from becoming a "theoretical demand analyst," whose training would prepare him to cooperate effectively with commodity specialists. Most graduate curricula tend to make him *either* an economic theorist (verbal or mathematical), *or* a probability theorist, *or* a mathematical statistician (specializing in variance analysis, sampling theory, or experimental design). No one of these specialties prepares him to give well-rounded advice to commodity experts concerning the statistical measurement of economic relationships. The verbal economist is too verbal; the mathematical economist too mathematical; and the statistician too disdainful of nonexperimental data. In ignorance or desperation the commodity economist turns to empiricism, and it is too empirical.

The remedy for this lies in the fact that demand analysis draws heavily only on special portions of the disciplines mentioned. Henry Schultz recognized this, and his monumental *Theory and Measurement of Demand* (1938) came close to exhausting the then available knowledge relevant to demand analysis. Wold also has tried to bring the relevant topics together under a single cover. The result should be stimulating to anyone who has a serious interest in demand analysis.

Wold's objectives in writing *Demand Analysis* are set forth quite explicitly in his preface: "The volume sets out to give a systematic account of demand analysis methods, employing for illustrative material the empirical studies of the authors into the structure of consumer demand in Sweden . . . The (theoretical) subjects of main relevance are on the one hand the theory of consumer demand, on the other the theory of regression analysis and certain topics in the theory of random processes."

Parts II-IV of the book deal with these theoretical subjects. Rather advanced arguments are involved at some stages, and many of them are stated and proved in the form of mathematical theorems. None of these parts will be accessible to nonmathematical readers without help. However, a striking and desirable feature is that even the most abstract developments are related to problems of practical concern in demand analysis. It is this awareness of problems encountered in empirical studies that distinguishes Wold's writing from that of most econometricians—the level of mathematical difficulty is the same.

Fortunately, the leading conclusions of parts II-IV are summarized in part I (pages 1-79). This section is written in nontechnical form and deserves to be widely read. It should be of interest to research economists generally, and will be useful supplementary reading for upper division courses in economic statistics or in agricultural price analysis. The book as a whole could be used as a principal text only at the graduate level and with students who have had upper division courses in both economic theory and statistics.

To many readers Wold's reaffirmation of the usefulness of least-squares regression methods in the analysis of demand will be the most interesting and challenging feature of the book. Wold objects to the formalism of much modern econometric theory and forthrightly embraces the concept of cause and effect as a basis for selecting dependent variables in regression equations. He feels that the qualifications raised by the simultaneous equations approach are generally of secondary importance for statistical demand analysis.

He argues further that many structures which appear to involve simultaneous equations can be resolved into a succession or hierarchy of

cause and effect relations, each of which can be fitted by the method of least squares. In summary, he says, "the final conclusion must be ... that the regression analysis as traditionally applied is essentially sound. In demand analysis at least it can still be safely recommended."

While this reviewer agrees that traditional methods are applicable in demand analysis for many farm products, he is by no means sure that they, or Wold's "recursive" extension of them, will fit all possible commodity situations. It should also be observed that some of Wold's practical conclusions are inadequately supported. A notable example is the lame discussion of trend removal and its relation to short- and long-term elasticities (pages 240-242). Another is his implication (pages 12-14) that an equation showing (aggregate) consumption as a function of retail price expresses a "unilateral causal dependence." For an individual consumer, yes; for a national aggregate of all consumers, no, or maybe!

After the rigorous theoretical developments in parts II-IV, the empirical results in part V are anticlimactic. The family-budget analyses are straightforward, and interesting for their own sake; the time-series analyses suffer from inadequate consumption data. The methods used to extort elasticities from the weaker series are ingenious but not convincing. Despite the importance of Wold's achievement, his book still reflects the dichotomy which plagues this field—the theory, too mathematical; the practice, too empirical! *Karl A. Fox*

Studies in the Structure of the American Economy. By WASSILY LEONTIEF AND OTHERS. Oxford University Press, New York. 1953. 561 pages. $11.

AN IMAGINATIVE agricultural economist will get many intriguing ideas from this book. Most important, he will see possible ways of measuring interrelations between agriculture, labor, and business. Also, he will be especially interested in the chapters on interregional economics by Leontief and Isard, the chapter on the structure of the cotton textile industry by Anne P. Grosse, and the chapter on demand by James S. Duesenberry and Helen Kistin.

With the help of nine other economists and statisticians, Leontief presents a clear, readable account of the theory and application of "inter-industry studies" or "input-output studies." In an excellent introduction to Part I, Leontief emphasizes the need for quantitative statistical work in economics. Here most agricultural economists will recognize a kindred spirit. Without doubt, empirical measurement is the strongest point of our profession. We can learn from Leontief something worthwhile about that subject. If we are willing to work on it, we can learn even more about economic theory.

A fairly simple but excellent presentation of the theory of inter-industry economics is to be found in Part I. It includes not only the usual static theory, but also discussions of structural changes and of the problems of dynamic analysis. Dynamic analysis at best is difficult. And, like the reviewer, many readers may have trouble with the mathematics of a dynamic matrix. But it would pay agricultural economists to read carefully all of Part I, including the part on dynamics. After all, we are mainly interested in prediction. We want to know how today's situation will affect farm production, prices, and incomes next month or next year. We can't escape dynamics.

Leontief also has a chapter on interregional theory. This and the following chapter by Isard, with empirical results of a regional input-output analysis, suggest important areas for research in agricultural marketing. Too little practical work has been done to measure the effects of various factors that influence the geographical distribution of a commodity. Still less has been done to learn what kind of geographical distribution would be desirable from

the standpoint of dietary needs or of increasing farm income. These two chapters should suggest ways of analyzing such matters.

The chapter on the cotton industry describes certain technical relationships which are said to be "sufficient to determine required inputs of direct processing machinery, power, labor, and fiber for the production of a specified type of cotton cloth with equipment of recent vintage." This is a production function in terms of "technical experts' opinions of best practice currently feasible."

In the final chapter, Duesenberry and Kistin present an analysis of the demands for food, clothing, and housing. Their study is based upon inter-temporal comparisons of budget studies. They estimate the price-elasticity for food to be 0.8. This is much higher than most statistical estimates based upon studies of national aggregate consumption and prices. Perhaps this may be partly owing to differences in concept. For example, this study uses deflated food expenditure as a measure of consumption. Most other studies use an index of the quantity of food consumed. It would be theoretically possible to derive elasticities and cross elasticities from an analysis of the complete inter-industry matrix. But it has not yet been done.

The techniques developed by Leontief and his group may enable economists to digest the enormous quantity of statistical data now available, and thus help us to understand how the economy works. *Frederick V. Waugh*

Productivity and Economic Progress. By FREDERICK C. MILLS. National Bureau of Economic Research, New York. 1952. 36 pages. $0.75.

Economic Change. By SIMON KUZNETS. W. W. Norton & Co., Inc., New York. 1953. 333 pages. $4.50.

HERE ARE TWO CONTRIBUTIONS by highly skilled craftsmen in economic measurement and economic analyses. Both relate to trends in economic growth. In addition, the reviewer may be pardoned for treating them in a single review because the professional careers of the authors have paralleled. Both have been closely associated with the National Bureau of Economic Research for more than a quarter of a century; both are past presidents of the American Statistical Association; and both are professors of economics and statistics (Mills at Columbia and Kuznets at the University of Pennsylvania).

Mills' brief pamphlet is concerned with measuring the role of productivity in the economy over the last half century. During that period, Mills points out, "The real national product of the United States increased 2½ times.... Over the same period, the total volume of human effort going into production (measured by man-hours of labor output) increased by 80 percent. The great gain in total output was won with an increase in labor input well below the increase in population." These measurements are based on decade averages developed by Mills. With these changes as a starting point, he outlines the uses to which the expanding productive power has been put.

During the first half of this century, there was an unbroken advance in productivity (average physical output per man-hour of work). Over the 50 years, gains in productivity have been responsible for 60 percent of the total gain in output. Even in the depression-ridden decade of the 1930's, productivity continued to rise. The period following World War I is of special interest in that the build-up of capital goods and of production techniques brought a sharp advance in the rate of productivity. Striking gains in productivity are again being realized in the post-World War II period.

Mills then turns to the measurement of the uses of the gains in productivity and output. In analyzing decade-to-decade changes and making allowances for maintaining capital stock and consumption levels per person, and the uses of output in war and defense, he finds that about 70 percent of the increase in output over the last five decades has gone toward increasing

levels of consumption, and the remainder for increasing the capital stock of the economy. The increase in per capita standards of consumption has been tremendous in the decade of the forties as compared with any previous decade. As Mills points out, "Gains in consumption levels are persistent and once realized are defended with tenacity." This has real implications for maintaining an encouraging view of economic stability in the future, particularly so because of the large liquid assets that have been accumulated by individuals in the last decade.

While Mills' work is concerned with a specific problem and specific measurements, Kuznets' volume is concerned more with thoughts and questions about a broad range of problems. The subtitle of his book is "Selected Essays in Business Cycles, National Income, and Economic Growth." In a sense, these essays, most of which have appeared in professional journals in the last 20 years, add up to a comprehensive inventory of major problems in these fields. The problems of business-cycle analysis which take up the first 4 essays of a total of 11, bring out the inadequacies of equilibrium economic theory as a tool in business-cycle analysis. He takes exception to the "closed character of the static system." He finds it essential to assume not only that the absolute economic quantities change but also that their relations change. "Just as it would be unwise to accept a rigidly defined norm of human behavior when seeking changes in the pattern of economic behavior caused by changing environment, so also would it be unwise to accept the cardinal assumption of rigid interdependence among social phenomena in a study attempting to establish changes in this dependence."

The essay this reviewer enjoyed most was Kuznets' review of Schumpeter's "Business Cycles," which was an attempt to integrate equilibrium theory with business-cycle theory. In Schumpeter's theory, technical innovations are the strategic element in the evolution of the economy. Here the economic analyst in Kuznets gains the upper hand over the theorist. Kuznets tries to test Schumpeter's theories quantitatively and fails to find enough to validate the Schumpeter thesis. Perhaps it is too much to expect that Kuznets will believe what he cannot measure.

In three essays concerning national income, Kuznets explores the problems of concepts and measurement of national income for countries with varying degrees of industrial development; the problem of measuring economic welfare; and finally the limitations of analyses of international differences in income levels. In the latter essay, his reflections on the causes of international differences in income levels will be of special interest to those concerned with foreign investment or the Point IV program. In the final three essays, he directs his attention to the main elements of growth in the economy. An essay, "Retardation of Industrial Growth," published in 1929, summarizes the factors that tend to make for a decreasing rate of growth in industry within a nation, and provides a background from which probably were developed many of the "mature economy" ideas which flourished in the 1930's. Another essay in this group, "Economic Tendencies, Past and Present," published just before Pearl Harbor, goes further in forecasting the impact of the war on our economic structure than anything else seen by this reviewer.

The broad learning and experience of Kuznets is apparent on almost every page. Most of these essays, and certainly the more stimulating ones, have appeared in professional journals, but it is well to have them in one place.

Nathan M. Koffsky

Crete. A Case Study of an Underdeveloped Area. By LELAND G. ALLBAUGH. Princeton University Press, Princeton, N. J. 1953. 572 pages. $7.50.

THE UNITED NATIONS and its specialized agencies, as well as many individual governments and private organizations, are giving a great deal of attention these days to the problems of underdeveloped areas. Programs of technical aid have been inaugurated on both a multilateral and a bilateral basis to assist these countries with their problems. One of the crucial questions, common to all such efforts, is what approach to use—in what ways and by what means can the knowledge and skills of the industrialized countries best be utilized to assist the peoples of the underdeveloped areas to improve their economic and social well-being.

In 1948 the Rockefeller Foundation at the invitation of the government of Greece undertook a survey of the Island of Crete in an effort to discover what kinds of assistance can be usefully given to an underdeveloped area and in what ways it can be most effectively used. The book under review is a report of that survey, which was under the direct supervision of Leland G. Allbaugh. Dr. Allbaugh, one of our better known agricultural economic specialists, was assisted by a very competent staff, included among whom were Ray Jessen and Norman Strand of the Iowa Statistical Laboratory, who were directly responsible for developing the survey methodology that was used and for directing the survey itself.

The Crete study was conceived by the Foundation primarily as an experiment in fact finding. They sought answers to two questions, What should be known about an underdeveloped country before steps are taken toward instituting changes in it? and How much of such necessary information can be obtained, and by what means? Several approaches obviously can be used to get information about a country. The approach selected in this study was to make a cross-section survey of representative communities, households, and farms of Crete. They sought by this means to obtain a realistic cross section of the life of the people whose level of living was the primary concern of the inquiry.

The sample consisted of 740 households in 40 communities and 4 municipalities—600 of these households were in the rural zones and 140 in the municipalities. The sample was so selected as to comprise 1/150th of all households on the Island. Detailed information was obtained on a wide variety of subjects including agriculture and other resources, industry and commerce, the Cretan family, food and nutrition, health, community facilities and living levels, Government organization, and related subjects. The findings with respect to each of these headings are summarized in a series of chapters in part II of the book. There is also an excellent summary of the whole study in part I and a detailed series of appendices in part III, including a number of supplementary statistical tables.

The Crete study demonstrates how it is possible to obtain a clear understanding of the essential elements of an underdeveloped economy, the problems it faces, and the actions required to meet them through use of scientific sampling survey techniques of the kind used in this inquiry. The approach developed undoubtedly could be repeated in other underdeveloped areas with equal success, provided funds and equally competent personnel were available. There is some question, however, whether many governments would see the need, or would make the necessary outlay, for such a careful appraisal before taking action. If this is true, it is unfortunate, as their efforts undoubtedly would be more fruitful and would be subject to less uncertainty and risk if they followed an approach similar to that set forth in this book.

F. F. Elliott

United Nations Statistical Yearbook 1952. Prepared by the STATISTICAL OFFICE OF THE UNITED NATIONS. Columbia University Press, New York. 1952. 554 pages. Clothbound $7.50, paperbound $6.00.

THIS IS THE FOURTH ISSUE of the Statistical Yearbook. Previous issues were published in 1948, 1950, and 1952. The current issue contains 177 tables, an appendix, and separate alphabetical subject and country indexes. The territorial coverage of the tables is as worldwide as available information permitted. Many tables give world totals. The statistical series for the various countries is presented on as comparable a basis as possible. To that end index numbers were converted to a common base (1948 = 100). Most tables cover 1932-51 (1932/33-1951/52); several cover 1929-51; and some are brought up to the early part of 1952. Corresponding data for 1928-31 can generally be found in the preceding issues of the Yearbook. The principal information is given under these chapter headings: Agriculture, Balance of Payments, Communications, Construction, Consumption, Education and Culture, Electricity and Gas, External Trade, Finance, Fishing, Forestry, Industrial Production, Internal Trade, Manpower, Manufacturing, Mining and Quarrying, National Income, Population, Public Finance, Social Statistics, Transport, Wages and Prices, Appendix, and Indexes.

Selected Recent Research Publications in Agricultural Economics Issued by the Bureau of Agricultural Economics and Cooperatively by the State Colleges [1]

BADGER, HENRY T. MARKETING CHARGES FOR CARROTS SOLD IN PITTSBURGH, PA., DEC. 1949-JUNE 1950 AND IN CLEVELAND, OHIO, FEB.-JUNE, 1950. U. S. Dept. Agr. Marketing Research Rept. 31, 36 pp., illus. (RMA)

From February through June, retail margins for size 72 Western carrots sold in sample stores in Pittsburgh averaged $1.52 per crate and 23.6 percent of the consumer's dollar during the period; in Cleveland $1.65 a crate, or 24.6 percent. The figures differed somewhat for Texas carrots. The wholesale margin averaged about 10 percent of the consumer's dollar for Western and Texas carrots in both cities during the respective periods studied.

BONNEN, C. A., MCARTHUR, W. C., MAGEE, A. C., and HUGHES, W. F. USE OF IRRIGATION WATER ON THE HIGH PLAINS. Tex. Agr. Expt. Sta. Bul. 756, 43 pp. December 1952. (BAE cooperating.)

Irrigation from wells has greatly increased the stability of agriculture on the High Plains of Texas. Since 1934, the number of wells has increased from 300 to more than 16,000 and the acreage irrigated from 35,000 to more than 2 million.

CHURCH, DONALD E., and SNITZLER, JAMES R. TRUCKS HAUL INCREASED SHARE OF FRUIT AND VEGETABLE TRAFFIC. 24 pp. Bur. Agr. Econ. April 1953. (RMA) (Processed.)

From 1948 to 1951, the diversion of rail traffic to trucks, as judged by unloads of 8 selected fresh fruits and vegetables at 10 large markets, equaled 12,000 carloads, or 5 percent of the total 1951 unloads. Of this total, somewhat more than half was represented by potatoes and tomatoes.

FOSSUM, M. TRUMAN. TRADE IN HORTICULTURAL SPECIALTIES. A STATISTICAL COMPENDIUM. U. S. Dept. Agr. Marketing Research Rept. 33, 116 pp., illus. April 1953. (RMA)

This report presents historical and up-to-date information concerning the production and distribution of floricultural and ornamental horticultural crops. In 1950, horticultural-specialty farms numbered 45,000.

GAINES, J. P., and DAVIS, JOE F. ELECTRICITY ON FARMS IN THE CLAY HILLS AREA OF MISSISSIPPI. Miss. Agr. Expt. Sta. Bul. 493, 42 pp., illus. August 1952. (RMA)

Discusses the consumption of electric energy on farms and the place of electricity in the whole scheme of farm mechanization.

GARLOCK, FRED L., WALLACE, MALCOLM E., BIERMAN, RUSSELL W., and LOVE, HARRY M. FINANCIAL STRUCTURE OF VIRGINIA AGRICULTURE. U. S. Dept. Agr. Agr. Inform. Bul. 97, 59 pp., illus. February 1953. (Federal Reserve Bank of Richmond and Virginia Polytechnic Inst. cooperating.)

Chief weakness in the financial structure of Virginia agriculture is the large number of commercial farmers

[1] Processed reports are indicated as such. All others are printed. State publications may be obtained from the issuing agencies of the respective States.

who operate on a scale too small to produce an adequate income. Most of these farmers have little in the way of liquid financial reserves. Their problems include low income, small net worth, little use of credit and an apparent aversion to operating as tenants. Ways to break this circle of relationships are discussed.

HEADY, EARL O., and OLSON, RUSSELL O. SUBSTITUTION RELATIONSHIPS, RESOURCE REQUIREMENTS AND INCOME VARIABILITY IN THE UTILIZATION OF FORAGE CROPS. Iowa Agr. Expt. Sta. Research Bul. 390, pp. 867-938. September 1952. (BAE cooperating.)

Farmers find that three sets of relationships determine the forage utilization system that will be most profitable for them: (1) The rate at which forage substitutes for other feeds in the livestock ration and the rate at which forage substitutes for grain in the crop rotation; (2) capital and labor requirements; and (3) risk and uncertainty.

HECHT, REUBEN W., and MORGAN, Q. MARTIN. LABOR AND POWER USED FOR FARM ENTERPRISES, PENNSYLVANIA, 1950. U. S. Bur. Agr. Econ. F.M. 102, 32 pp., illus. February 1953.

Man- and power-hours are listed for 16 crops and for milk cows and young dairy stock, and chickens.

JOHNSON, DEHARD B. MARKETING CHARGES FOR ORANGES SOLD IN PITTSBURGH AND CLEVELAND, 1949-50 SEASON. U. S. Dept. Agr. Marketing Research Rept. 27, 40 pp., illus. January 1953. (RMA)

Retail margins averaged $1.93 a box (23.3 percent of the retail price) for California oranges sold in Pittsburgh and $2.01 a box (23.2 percent of the retail price) in Cleveland. The corresponding figures for Florida oranges were: For Pittsburgh $1.77 a box (24.4 percent of the retail price) and for Cleveland $1.79 a box (23.1 percent of the retail price). The time periods covered differ for the two cities—for Pittsburgh December through June and for Cleveland February through June. Therefore, the comparisons are not exact.

LARIMORE, DONALD E., and BLACK, JOHN D. EXTENSION EDUCATION IN MARKETING IN THE COOPERATIVE FEDERAL-STATE AGRICULTURE EXTENSION SERVICE OF THE UNITED STATES—AN EXPLORATORY STUDY. Harvard Studies in Marketing Farm Products 6-H, 64 pp. January 1953. (RMA, BAE cooperating).

Inventories existing extension activities in agricultural marketing, which cover a wide range, and presents an outline of a systematic and orderly extension program that could be put into effect by individual State extension services.

MCDANIEL, W. E., and POND, G. A. CHANGES IN THE DAIRY FARMING PICTURE, THEIR EFFECT ON FARMERS' EARNINGS AT VARIOUS PRICE LEVELS. Minn. Agr. Expt. Sta. Bul. 416, 20 pp., illus. January 1953. (BAE cooperating.)

These changes include substitution of mechanical for animal power, general mechanization of the farm business, and adoption of new varieties of crops and new practices in crop and livestock production. These new techniques have resulted in increased output per man, per acre, and per animal. The increased earnings are highest in years when the purchasing power of farm products is relatively high.

MORGAN, Q. MARTIN, and HECHT, REUBEN W. LABOR AND POWER USED FOR FARM ENTERPRISES, MISSISSIPPI, 1950. U. S. Bur. Agr. Econ. F.M. 103, 31 pp., illus. April 1953. (Processed.)

Lists required man- and power-hours for 16 crops and for milk cows, other cattle, hogs, and chickens.

UNITED STATES BUREAU OF AGRICULTURAL ECONOMICS. CROP PRODUCTION PRACTICES. LABOR, POWER, AND MATERIALS, BY OPERATION, MOUNTAIN AND PACIFIC STATES. U. S. Bur. Agr. Econ. F.M. 92, Sec. 5, 302 pp., illus. March 1953. (Processed.)

Presents information for such irrigated and nonirrigated crops as barley, corn, grain sorghum, and wheat, among others.

UNITED STATES BUREAU OF AGRICULTURAL ECONOMICS, and BUREAU OF EMPLOYMENT SECURITY, UNITED STATES DEPARTMENT OF LABOR. UNEMPLOYMENT AND PARTIAL EMPLOYMENT OF HIRED FARM WORKERS IN FOUR AREAS (A SUMMARY REPORT). 18 pp., illus. April 1953.

Shows some data concerning the characteristics of the group of workers surveyed, their status in the farm labor force, patterns of employment and unemployment, and willingness to accept farm and nonfarm jobs during off seasons. Most of the data relate to the 12 months immediately preceding May 1952 when the survey was made.

Statistical Compilations

UNITED STATES BUREAU OF AGRICULTURAL ECONOMICS. POTATOES: ACREAGE, PRODUCTION, VALUE, FARM DISPOSITION, JAN. 1 STOCKS (1866-1950). U. S. Dept. Agr. Statis. Bul. 122, 109 pp., illus. March 1953.

UNITED STATES BUREAU OF THE CENSUS and BUREAU OF AGRICULTURAL ECONOMICS. 1950 CENSUS OF AGRICULTURE. SPECIAL REPORTS. FARM-MORTGAGE DEBT. Cooperative Rept. v. 5, pt. 8, 35 pp., illus. December 1952.

UNITED STATES BUREAU OF THE CENSUS and BUREAU OF AGRICULTURAL ECONOMICS. 1950 CENSUS OF AGRICULTURE. SPECIAL REPORTS. IRRIGATION 1950. A GRAPHIC SUMMARY. Cooperative Report. v. 5, pt. 7, 35 pp., illus. Washington, D. C., Govt. print. off. 1952.

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